Highlights

Vol. II No. 11
June 1, 1959

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Washington SCIENCE TRENDS

New Submarine Reactor?

Vice Adm. Hyman G. Rickover is urging Congress to approve some $18,500,000 for a land-based prototype for a new natural circulation reactor plant to be used in submarines. Construction time is estimated at about two and a half years following authorization. The plant would eliminate the main coolant pumps and large check valves which complicate present systems. The general piping and electrical systems will also be simplified.

Rickover also proposes a new reactor core for the Shippingport, Pa. power-plant, designed to increase capacity from 60,000 to 150,000 KW. The project would require about $5 million for modifications to the nuclear plant and some $15 million for additional generating capacity. This is in comparison to costs of $100 to $120 million for a complete new complex.

Shippingport conversion, according to Rickover would be a "very significant step in the direction of approaching competitive atomic power." Shippingport power now costs about eight or nine times more than conventional supplies although, due to the "laboratory" nature of the plant, costs are not fully comparable.

Rickover's Comments on cost comparisons: "The cost of nuclear power is much higher today. It is higher for those plants which are operating. It is low for all plants which have not been built...All plants for which people come in here and ask for appropriations are always cheap, easy to build and have no problems. But when you start building them they become more difficult and power costs more..."

Antiradar Missiles?

Air Force is planning to spend some $23,000,000 in the next Fiscal Year in R&D work on an anti-radar missile (ARM). The project is the largest in terms of dollars in the strategic weapons system R&D area, with the exception of aircraft nuclear propulsion.

ARM is described as a "positive electronic countermeasure." It would be employed to "destroy" enemy detection and control equipments so that manned bombers may better penetrate well-defended enemy territory for precision attacks against hardened targets.

An additional $5,000,000 is being requested for other advanced penetration aids in the air to surface field, possibly a combination decoy and "radar buster" missile. The sum would cover R&D in components, but not a complete weapon system.

Project Transit

First launching is expected later this year in a program to provide a precision navigation system with satellites. Air Force missiles will be used, with payloads by Lockheed Aircraft and Johns Hopkins University. Advanced Research Projects Agency (ARPA) plans to spend some $16,500,000 on Project Transit R&D through June, 1961. The system will be under Navy operation.

Initial Phase -- ARPA is supporting the initial phase of the precision navigation system with a study of Doppler navigational techniques. In this phase a relatively simple transponder with coded output will be used.

Operating Principles -- According to plans, a receiving station will listen to a radio frequency signal transmitted by the satellite as it comes over the horizon. This signal frequency is initially shifted due to the rate of approach of the satellite to the receiver. The satellite, according to information provided Congress, will relay to the receiving station the signal for the shift, a coded signal of synchronous time and a coded signal representing orbital characteristics.

Potential Accuracy -- It is expected that the proper use of this information will permit location within a circle of about four-tenths of a mile. Precise knowledge of the satellite orbit and time is expected to lead to accurate geographic position determination.

Potential Applications -- Precise knowledge of location or position can be of prime importance in such military operations as the launching of ballistic missiles from submarines, or the initiation of changes in missile-in-flight trajectories. For navigation, a satellite radio source would be heard and detected by any ship, submarine or aircraft at any time of day or night, regardless of weather conditions.

Plasma Physics

National Bureau of Standards plans to start a new fundamental research program in the physics of plasmas. It is hoped that such studies may contribute toward controlled thermonuclear reactors but NBS activities will not be aimed at power production.

Research work is planned on the theory of plasmas and magnetohydrodynamics; mechanisms of energy loss from high temperature plasmas such as bremsstrahlung, neutrons, optical spectra, electron and ion energy distributions; energy transfer processes between charged particles of a plasma; transport properties of matter such as viscosity, thermal and electrical conductivities; radiation damage; wall effects and high temperature phenomena (SCIENCE TRENDS, May 25).

To support this program, NBS intends to purchase a plasma physics discharge tube and data recording assembly, soft x-ray and electron spectroscope, a high resolution vacuum spectograph and a high temperature "black body."

New support is also planned for study of absorption of radiation by negative ions. Research is closely linked to the thermodynamics of gases at high temperatures reached in rocket engines and explosions as well as many other fields, including gas-filled electronic devices and study of the stars.

Ground Effect Vehicles

Here is a new summary from the Pentagon of progress on unclassified programs in the field of ground effect or air-cushioning vehicles. Other details were reported in SCIENCE TRENDS, April 20, 1959:

Navy

Office of Naval Research

* Contract with Aerophysics Company of Washington, D.C., for $30,000. Effective dates: October 1, 1958 to September 30, 1959. To investigate the theoretical aspects of the annular jet in and out of ground effect.

This contract was originally started on August 5, 1957 and the Summary Report AR 581-R "Aerodynamic Theory of the Annular Jet" was published in December 1958. It presents theories to describe the flow mechanics of air jets issuing from annular openings both in and out of ground effect.

Air Branch efforts to survey the field and determine the extent of further research efforts. Dr. G.B. Matthews and Maj. J.L. Wosser will present a paper titled "Ground Proximity: A Critical Review," at the annual summer meeting of the Institute of Aeronautical Sciences in June of this year.

* Contract with the University of California (Berkeley) for $20,000. Effective dates: April 1, 1959 to March 31, 1960. To test small models over water at varying forward flight speeds and different wave conditions. No results submitted to date.
* Contract with Iowa State University for $30,000. Effective dates: September 1, 1958 to August 31, 1960. To test models over ground and water utilizing the large towing tank investigating various parameters. No results to date.
* Contract under negotiation to purchase certain theoretical and experimental information from Mr. Carl Weiland of Zurich, Switzerland. (Approximately $2,300)
* Contract with Gyrodyne Co. of Long Island, N.Y., for $46,784. Effective dates: January 9, 1959 to August 1959. To build and test a man-carrying ground proximity machine 6 feet in diameter capable of lifting a payload of 300 pounds. No results to date.
* Contract with Convair for $49,622. Effective dates: May 1 to October 31, 1959. To study the feasibility and practicality of very large vehicles as ocean-going transports. No results to date.
* An experimental investigation with DTMB Hydro Group for $45,000. Effective dates: March 6, 1959 to June 30, 1959. To build rectangular and circular models to correlate the work being done at University of California and Iowa State.

Army

Transportation Corps

* Princeton Ground Effect Model Investigation -- Contract was awarded in September 1958 to Princeton University for a theoretical and experimental program to provide additional information on lift, propulsion, stability and control characteristics of annular jet configurations in hovering and forward flight, both in and out of ground effect.

Data has been obtained for a variety of two-dimensional and three-dimensional models differing in size, nozzle configuration, and flow conditions. This data is being utilized to develop empirical relationships and to provide a basis for correlation with theory. Approximately $25,000 has been expended through March 31, 1959. The remaining funds ($110,000) are sufficient to complete present program.

* Piasecki Aircraft Corp. Aerial Jeep -- Contract awarded in July 1959 to Piasecki Aircraft Corp. for design construction and tests of a research vehicle to explore the aerial jeep concept

The tandem-ducted-propeller research vehicle (employing tandem-helicopter-type controls) has been flown up to speeds of 20 miles per hour and to heights of approximately 20 feet. The research vehicle currently is being modified to install a 400 horsepower turbine powerplant as a replacement for the original reciprocating engines to reduce the vehicle weight and permit adequate exploration of the concept. Preliminary testing of the modified research vehicle has been initiated.

Approximately $1,310,000 of the authorized $1,383,000 has been expended to March 31, 1959. An additional $50,000 is estimated required to complete the research program.

* Chrysler Aerial Jeep -- Contract awarded in July 1957 to Chrysler Corp. for design, construction and tests of a research vehicle to explore the aerial jeep concept. The tandem-ducted-propeller research vehicle (employing fixed pitch propellers and duct inlet and exit vanes) has been completed and preliminary testing is underway prior to initiation of flight testing.

Approximately $980,000 of the authorized $1,112,000 has been expended through March 31, 1959. Remaining funds are believed sufficient to complete the research program.

* Curtiss-Wright Aerial Jeep -- Contract awarded in July 1957 to Santa Barbara Division (formerly Aerophysics Development Corp.) of Curtiss-Wright for design, construction, and tests of a research vehicle to explore the aerial jeep concept.

The four-propeller research vehicle has been completed and preliminary testing is underway prior to initiation of flight testing.

Approximately $840,000 of authorized $897,000 had been expended through March 31, 1959. Remaining funds sufficient to complete research program inasmuch as contractor has agreed to participate in cost of program and will fund excess over that authorized.

* Hiller Aircraft Corp. Downwash Impingement -- Contract was awarded to Hiller Aircraft Corp. on June 30, 1958, to determine the characteristics of deflected slipstream and downwash and resultant effect of slipstream and downwash on movement of particles (sand and dust). Contract is currently suspended pending revisions to plan of test to more adequately obtain best data desired which was not foreseen at initiation of contract. Test rig has been constructed and limited calibration tests conducted. Initial funding was $83,000. Revised contract estimates now indicate that contract will cost approximately $119,030 with no increase in fixed fees. No additional funding has been authorized, however, $40,253 will be required to prosecute revised program.

Ordnance Corps

* National Research Associates Contract.

Scope: A study to determine the feasibility of obtaining a minimum ground pressure vehicle primarily operated in contact with the ground, but capable of being supported by a dynamically created cushion of air for operation over land or water.

Background: A feasibility study contract was executed with National Research Associates, Inc., College Park, Md., by the Army Ordnance Corps on April 30, 1959. The contract provided for construction and demonstration of miniaturized models and a scale model to prove the technical feasibility, and to furnish studies and reports of results.

Status: This contract did expire on April 30, 1959. However, in view of results demonstrated thus far, a supplement is being negotiated to continue this project and obtain specific test data for possible future application to a larger full-scale vehicle. An additional supplement is also being planned which would use fiscal year 1959 funds. These two supplements will extend the performance date of the contract well into late calendar year 1959.

Results to date: At this time the contractor has demonstrated the miniature models in air suspension over hard surfaces and water. A 5-foot by 10-foot model, powered by a four-horsepower motor and weighing approximately 100 pounds, has also been built and operated about 12 inches by 16 inches over rough terrain surfaces. Detailed data, based on studies and tests to date are being compiled. Funding summary: Fiscal Year 1958 $57,700 Research and development; Fiscal Year 1959 $25,000 Research and development (Firm); Fiscal Year 1959 $29,000 Research and development (Planned).

Avrocar -- Tight security is still being maintained on the ground cushion vehicle with flight capabilities being constructed by Avro Ltd. of Canada. Testimony just released by the House Committee on Science and Astronautics indicates high Army hopes for use in reconnaissance and security units and as tactical rocket carriers. The vehicle is disc-shaped, using Orenda engines. Initial flights will take place in Canada, with wind tunnel testing at the Ames Laboratories, Moffett Field, California, a facility of the National Aeronautics and Space Administration. The Army, according to the testimony, intends to keep the project classified for as long a period as possible because of its "unique features and potential performance." Army support of the project is listed as some $5 million over a three year period.

(For further information on the Ground Cushion program write House Committee on Science and Astronautics, New House Office Building, Washington 25, D.C. for Hearings, Ground Cushion Phenomena. 77 pages. Single copies free, as available)

Maritime Research and Development

Commerce Department and Maritime Administration are exploring the possible development of a fast sub-surface ship, employing "water jet propulsion" of advanced concept. According to the proposal, such a craft would run beneath the surface with a control tower or gondola on a knife-like connecting strut which would carry the vessel's personnel above the sea.

Safety at sea is also being studied. According to John J. Allen, Jr., Assistant Secretary of Commerce, the Department believes that it is possible to achieve automatic navigation through the inertial guidance principle, or through the so-called celestial navigation system generally referred to as the "star tracker."

Mace Cancellation?

The powerful House Appropriations Committee may have doomed plans for deployment of the Air Force - Martin Mace, a ground-launched tactical missile designed as an improved follow-on to the Matador. The Committee deleted all of the $127,500,000 for Mace Procurement and noted that "the Navy cancelled the Regulus II missile, of the same general type but with supersonic speed and more desirable operational characteristics, as being outmoded and no longer required in the defense program." The House group added that "existing weapons systems available to the military services are sufficient to meet the operational requirements envisaged for this missile..." Decision is still subject to review by the House and Senate.

PUBLICATIONS CHECKLIST

( ) Science and Government, testimony and discussions on proposals to create a single Department of Science and Technology in the U.S. Government. 105 pages. Single copies free. (Write Subcommittee on Reorganization, Committee on Government Operations, New Senate Office Building, Washington 25, D.C. for Science and Technology Hearings - Part One)

( ) Rare Earth Elements, a report of research on an emission spectrometric analytical method using direct-current carbon-arc excitation of various rare-earth-oxide mixtures. 13 pages. Free. (Write Publications Distribution Section, U.S. Bureau of Mines, 4800 Forbes Street, Pittsburgh 13, Pa. for Report of Investigations No. 5454)

( ) Germanium Recovery, describes an investigation into potential recovery of germanium from coal or coal ash. Includes test procedures and results of surveys on coal-fire steam generators in central-station powerplants. 68 pages. 50 cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. for Bureau of Mines Bulletin 575)

( ) Radioactive Fallout, a bibliography of technical reports current to July 1, 1958. Most of the reports are available from Government sources. 70 pages. $2. (Write OTS, U.S. Department of Commerce, Washington 25, D.C. for UCRL 8412)

( ) Euratom, a transcript of hearings and additional material on the programs and progress of the European Atomic Energy Community (Euratom) concerning peaceful uses of atomic energy. 150 pages. Free. Write Joint Committee on Atomic Energy, F-88, the Capitol, Washington 25, D.C. for Hearings - Agreement for Cooperation with Euratom)

( ) Helium, two new technical reports bearing on the characteristics of helium-bearing natural gas. (Not yet published but may be consulted in the Open File of Information Relating to Extraction of Helium at Room 514, Barfield Building, Amarillo, Tex. and Room 4627, Interior Building Washington 25, D.C.)

( ) Fractional Factorial Experiments, mathematical plans for experiments having 4 through 10 factors. Useful in jointly evaluating the characteristics of several factors with respect to some material or process. 37 pages. 30 cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. for NBS Applied Mathematics Series 54)

( ) Exponential Integral, original material designed to be of value in the physical sciences. Tables were prepared for use in atomic research but have found applications in fields such as fluid dynamics, in the study of turbine characteristics and in the theory of diffusion. $4.50. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. for NBS Applied Mathematics Series 51)

( ) Space Exploration, a well-written, semi-technical booklet covering space vehicles, celestial mechanics, the space environment and similar matters. Particularly suited for school use. 47 pages. Free. (Write NASA, Information Office, 1520 H Street, N.W., Washington 25, D.C. for The Challenge of Space Exploration)